Name _____Period _____

Rates of Diffusion

Your Tasks (Mark these off as you go)

- ☐ Define key vocabulary
- ☐ Make a prediction
- ☐ Test your prediction
- ☐ Analyze your data
- ☐ Interpret your results
- ☐ Receive credit for this lab

☐ Define key vocabulary

Kinetic Energy

Ideal Gas

Molecular velocity

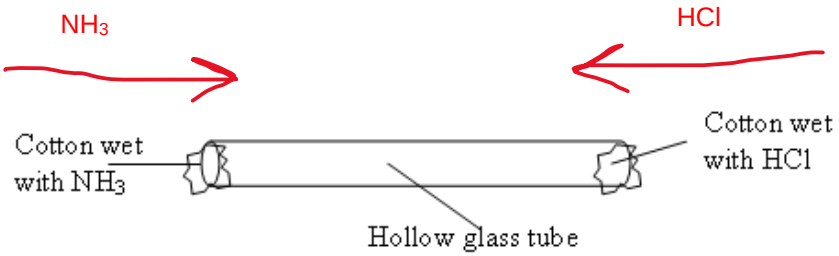
Effusion

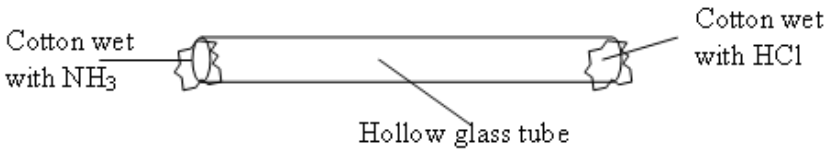
Diffusion

Precipitate

☐ Make a prediction

Hydrochloric acid and ammonia are both gases that react to form a gaseous precipitate. Because NH3 and HCl have different masses, they will diffuse through the tube at different rates.



Calculate the molar mass for both NH_3 and HCl
Based on the molar masses you calculated above, predict where you think the two gases will collide. Indicate this on the diagram below. Write a sentence to support your prediction.


☐ Test your prediction

Follow the procedure below to test your prediction
The cotton balls should be handled with tweezers. If you come in contact with the ammonia or hydrochloric acid, wash your hands immediately.   1. Label on end of the tube HCl. Label the other end NH_3.   2. Predict where the precipitate will occur in the tube and mark this spot   3. Add a few milliliters (about 20 drops) of ammonia to one cotton ball   4. Add a few milliliters (about 20 drops) of hydrochloric acid to another cotton ball   5. Simultaneously place the cotton balls on each end of the buret tube and secure as shown above.   6. Measure the distance between the cotton balls and record this value below   7. Watch carefully, then mark the location where the precipitate forms (this can take about 10 minutes)   8. Record the distance the hydrochloric acid (HCl) traveled in the tube below   9. Record the distance the ammonia (NH_3) traveled in the tube below

Data table

Distance between cotton balls	
Distance HCl traveled	
Distance NH_3 traveled	

☐ Analyze your data

To calculate the theoretical collision point you will use Graham's law. The following steps will walk you through the process.

- Calculate the molar mass of NH_3 _____ g
- Calculate the molar mass of HCl _____g
- Calculate the ratio of the square root of the molar masses of NH_3 and HCl

$$\frac{\sqrt{\text{molar mass } NH_3}}{\sqrt{\text{molarmassHCl}}} = \_\_\_\_\_$$

If we let "x" equal the distance NH3 should have traveled, then the distance HCl should have traveled is equal to the distance between the cotton balls minus x or,

Distance NH_3 travels = x
Distance HCl travels = distance between the cotton balls – x

Substitute the distance between the cotton balls with the value you recorded. Substitute the ratio that you calculated in step 3. Then solve the equation below for "x".

$$\frac{\text{distance between cotton balls - x}}{x} = \frac{\sqrt{\text{molar mass } NH_3}}{\sqrt{\text{molarmassHCl}}}$$

- The distance NH3 traveled (x) _____ cm

If "x" represents the distance NH_3 should have traveled. How far did NH_3 actually travel? Locate the value you recorded. Calculate the percent error associated with your value.

$$\text{Percent Error} = \frac{\text{actual distance } NH_3 \text{ traveled} - \text{theoretical distance}}{\text{theoretical distance}} \text{ x } 100$$

- Percent Error _____ %

☐ Interpret your results

Answer the following in complete sentences. You must also be mindful of spelling, punctuation and overall writing quality.

What was the purpose of this experiment?

In your own words, summarize what you did to accomplish the purpose.
Discuss how your prediction for where the collision should have occurred compared to the actual. Are they different? Why?
Consider the following gases. If experiment was repeated with different gases. Circle the pair of gases that would collide closest to the center of the tube? Provide an explanation. HCl and CH_3NH_3 HCl and NH_3 HBr and CH_3NH_2 HBr and NH_3

□ Receive Credit for this lab

Each group member must complete and submit their own lab to receive credit